

Families in Flats

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The fact that poor housing affects the health of the community has been understood since the time of Chadwick, but the ways in which housing can affect health, and the nature of the ill-health which may be caused by unsatisfactory housing, have changed. Over the past 25 years the health of people living in new towns and on new housing estates has been shown in several instances to be poorer than might have been expected, in spite of the improvements which have occurred in their sanitary environment.

Much of the blame for this has been ascribed to social factors, such as those described by Young and Willmott (1962) in their account of the movement of families from Bethnal Green to a new estate outside London, thus breaking their family links. Brotherston and Chave (1956) described a higher rate of attendance on their general practitioners by people who lived on a new housing estate than might have been expected; and Martin, Brotherston, and Chave (1957) found that the incidence of neurosis on a new housing estate was 77% in excess of the national average. Taylor and Chave (1964) described how on a new housing estate they found that there was a lowered threshold for consulting a doctor, which resulted in a higher rate of overt neurosis.

The effect of the adverse environment of new housing estates is well documented, but that of another phenomenon of modern housing development—namely, the building of blocks of multi-storeyed flats in large numbers—is not. Hird (1966) found an increase in illness in flats. He stated that in flat dwellers he found twice as many upper respiratory infections in children below the age of 10 as there were in house dwellers, and that he had twice as many consultations in which symptoms of emotional disturbance predominated.

It would appear that people who live in new housing estates and in new blocks of flats are often poorer in health than those who live in older and hygienically less satisfactory types of accommodation, even though the design and appointment of the new dwellings are thought to be greatly superior to the old. The morbidity which occurred among the families of some members of the armed Forces living in modern flats and houses in Germany was examined in order to compare the health of those who lived in the flats with those who occupied houses.

Scope of Survey

The records of 558 families were examined in detail over a period of 10 weeks from 30 August to 6 November 1965, including the practice records concerning attendances, referral for specialist opinion, and domicile of the patient. The families were chosen because they lived in two well-defined and comparable areas—one an estate of houses, similar in design and layout to a modern local authority estate, and the other an estate which was composed of three- and four-storey blocks of flats, also comparable with a similar arrangement in England. The period was relatively short, but was kept so in order to minimize the number of families who moved during the study. In fact, during the 10 weeks eight families moved away, and were replaced by another eight whose size, age, and sex distribution

were sufficiently similar not to affect the composition of the population.

All medical attendances were known to the practice, as it was in the circumstances the only one available, and all contact with the local hospital was arranged through it. The community was self-contained and self-sufficient, with all the amenities that are found on a well-developed housing estate in England, all services such as schools, churches, shops, buses, and entertainment being readily available. A time was chosen when attendances were neither markedly more nor less than usual, and there was no epidemic of infectious disease current. Attendances for the whole practice during 1965 included 11,187 consultations with a general practitioner from a population which averaged 2,480, a consultation rate of 4.51 per registered patient in the year. In the section which was studied there were 1,409 consultations with a general practitioner from the 1,608 patients over the 10-week period, which was equivalent to an annual rate of 4.56.

The section of the practice which was chosen had the following attributes: (1) They were all families of non-commissioned ranks; that is, in the same social class and income group. Though they were unclassified in the 1966 General Register Office Classification of Occupations, they were placed in class III in the 1950 classification. (2) Only those who were in a flat or a house by chance rather than by choice were included. The usual system was one of allocation of the next available dwelling to the family at the top of the waiting-list, but there were some exceptions to this, and these were excluded from the study. (3) Social facilities were comparable; that is, buses, schools, shops, and medical services were equally available. (4) They all came under the care of the same practice. This applied to the wives and children, but not to the men, who were therefore not included in the study. (5) They were all within walking distance of a doctor's surgery.

The age distribution of the two groups, which is shown in Table I, was sufficiently alike to permit comparison. The mean number of children per family in flats was 1.9 and in houses 1.8.

TABLE I.—Age Distribution of Populations in Flats and Houses

Age Group:	0-4	5-9	10-19	20-29	30-39	40+	Total
No. living in flats . .	374	250	143	232	128	36	1,163
" " " houses	121	85	77	77	50	35	445

The houses were of modern design, soundly built, and two-storeyed, in short terraces with a common front and individual back gardens, with two or three bedrooms, and centrally heated throughout. The flats were in blocks of three or four storeys, well laid-out in an open space with grass surrounds, with two or three bedrooms, and also centrally heated. Group A, living in 398 flats, comprised 1,163 women and children, and group B, living in 160 houses, 445 women and children.

Measurement of Morbidity

Most studies of illness in general practice use the total number of consultations with the doctor as a measurement of morbidity. It is felt that as the number of times that a doctor may see a

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patient with any particular illness may vary with his personal preference, clinical methods, experience, or work load, or with factors imposed by the patient, a more precise measurement of morbidity is obtained by using a "first consultation rate," as described in the Registrar General's subcommittee report on measurement of morbidity (1954). This measurement is that of the number of first consultations for an illness or disease during a defined period, related to the average number of persons exposed to risk during that period. As, particularly in the case of respiratory infections, any patient may attend with more than one illness during a specified period, the number of patients consulting a general practitioner during the 10-week period of the survey has also been recorded. Both these measurements have been used to compare the women and children who lived in flats with those who lived in houses. The number exposed to risk is taken as the population at the beginning of the survey.

Differences in Types of Illness

The total number of first attendances, referrals to specialists, and admissions to hospital is shown in Table II.

TABLE II.—Attendances by Families From Flats and Houses Over the 10-Week Period

	Group A: Flats			Group B: Houses		
	No. of Patients Attending	No. of First Attendances	Rate per 1,000 in Group	No. of Patients Attending	No. of First Attendances	Rate per 1,000 in Group
First attendance by G.P. for any reason ..	672	696	598.5	162	170	382.0
Referred to specialist ..	81	81	69.6	19	19	42.7
Admitted to hospital ..	25	25	21.5	11	11	24.7

The differences in the rates of first attendance by the general practitioners show an increase of morbidity of 57% in those families who lived in flats compared with those who lived in houses, and the difference in the rates at which they were referred for specialist opinion was 63%. The proportion admitted to hospital was nearly the same in both groups, and this may indicate that though the amount of illness in the flats was greater than that in the houses, the degree of seriousness was not.

The nature of the increased morbidity was established by classifying the diagnoses made according to the World Health Organization *International Classification of Diseases*, and this is shown in Table III. The most frequent diagnosis in both groups was of disease of the respiratory system; 35.1% of all illnesses seen in patients from flats, and 26.5% seen in those from houses, fell into this category. The difference between the incidence in the two groups is significant at the level of $P < 0.01$ if a χ^2 test is applied. The predominant illness was infection of the upper respiratory tract, but it is interesting to note that a diagnosis of bronchitis or of pneumonia was made in 14 instances in patients who lived in houses, and 66 times in those who lived in flats, which represents incidences of 31.5 and 56.7 per 1,000 respectively, the difference between which is significant at the level of $P < 0.05$. A similar difference ($P < 0.05$) was seen in the incidence of disorders of the nervous system and sense organs, which were partly related to the respiratory diseases, as they included cases presenting as acute otitis media which were precipitated by nasopharyngeal infection.

Genitourinary disorders were more than twice as common in women who lived in flats as they were in those in houses, the most frequent form being a menstrual irregularity. The doctors concerned were all of the opinion that they were associated with the incidence of psychoneurotic disorders,

which were twice as frequent in flats as they were in houses, and the differences in incidence in each case are significant at the level of $P < 0.05$.

There was one significant difference where the incidence of a group of disorders was higher in the families in houses than it was in those who lived in flats—namely, those which fell

TABLE III.—Comparison of Rates of First Attendance by General Practitioners on Both Groups, According to the Diagnoses Made

Disease Group	Group A: Flats			Group B: Houses		
	No. of Patients Consulting	No. of First Attendances	Rate per 1,000 in Group	No. of Patients Consulting	No. of First Attendances	Rate per 1,000 in Group
I. Infective and parasitic ..	18	18	15.5	6	6	13.5
III. Allergic, endocrine, and metabolic ..	23	23	19.8	3	3	6.7
IV. Blood disorders ..	4	4	3.4	4	4	8.9
V. Mental and psychoneurotic ..	42	42	36.1	8	8	17.9
VI. Nervous system and sense organs ..	48	48	41.3	7	7	15.7
VII. Circulatory system ..	6	6	5.2	1	1	2.2
VIII. Respiratory system ..	227	244	209.8	38	45	101.1
IX. Digestive system ..	77	77	66.2	27	27	60.7
X. Genitourinary system ..	61	61	52.5	10	10	22.5
XI. Complications of pregnancy ..	5	5	4.3	2	2	4.5
XII. Skin and cellular tissue ..	31	32	27.5	7	7	15.7
XIII. Bones and organs of movement ..	11	11	9.5	11	11	24.7
XVI. Unknown and undiagnosed ..	65	71	61.0	12	13	29.2
XVII. Accidents ..	26	26	22.4	16	16	35.9
XVIII. Non-sickness ..	28	28	24.1	10	10	22.5
Total ..	672	696	598.5	162	170	382.0

into the group of disorders of the bones and organs of movement, which were more than twice as frequent in women in houses, and under which heading were collected a variety of diagnoses, the most frequent being the low-back-strain syndrome ($P < 0.05$).

Differences Between Age Groups

Some age groups showed a greater difference in the incidence of sickness between flats and houses than others, and this is shown in Table IV.

TABLE IV.—Differences in Rates of First Consultation With the General Practitioners Between Those Living in Flats and Those in Houses, by Age Groups

Age Group	Group A: Flats			Group B: Houses		
	No. of Patients Consulting	No. of First Consultations	Rate per 1,000 in Age Group	No. of Patients Consulting	No. of First Consultations	Rate per 1,000 in Age Group
0-4	232	250	668.4	47	53	438.0
5-9	123	125	500.0	24	26	305.9
10-19	58	59	412.6	18	18	233.8
20-29	165	166	715.5	39	39	506.5
30-39	74	75	585.9	22	22	440.0
40+	20	21	583.3	12	12	342.9
Total ..	672	696	598.5	162	170	382.0

With the children there was a higher sickness rate in those under 5 years in both groups than in their older siblings, as might be expected, but there was a marked difference between those in all age groups who lived in flats and those who lived in houses. With the women, the greatest difference between flat- and house-dwellers was in those of 40 years and over, and in those in their twenties, with a much smaller difference between those in their thirties. The major difference in sickness

rates between the children from the flats and those from houses was seen in the incidence of respiratory disorders in those under the age of 10. This difference narrowed in those aged from 10 to 19, but increased again slightly in the young mothers of 20 to 29, as is shown in Table V.

TABLE V.—*Differences in Rates of First Consultation With the General Practitioners for Disorders of the Respiratory Tract Between Those Living in Flats and Those in Houses, by Age Group*

Age Group	Group A: Flats		Group B: Houses	
	No. of First Attendances	Rate per 1,000 in Age Group	No. of First Attendances	Rate per 1,000 in Age Group
0-4	134	358.3	26	214.9
5-9	60	240.0	8	94.1
10-19	16	111.9	4	51.9
20-29	22	94.8	3	38.9
30-39	9	70.3	3	60.0
40+	3	83.3	1	28.6

The principal differences in the incidence of psychoneurotic disorders were seen in the women aged between 20 and 29, and, so far as can be judged from the small numbers in the population surveyed, in those over 40. This is shown in Table VI.

TABLE VI.—*Differences in Rates of First Consultation With the General Practitioners by Women for Psychoneurotic Disorders Between Those Living in Flats and Those in Houses, by Age Group*

Age Group	Group A: Flats		Group B: Houses	
	No. of First Attendances	Rate per 1,000 in Age Group	No. of First Attendances	Rate per 1,000 in Age Group
20-29	24	103.4	3	38.9
30-39	8	62.5	3	60.0
40+	3	83.3	0	0

The conclusions to be drawn from these figures are that there was an increase in general morbidity in the families who lived in flats as compared with those who lived in houses, and that this increase was most pronounced in children under the age of 10, who had more respiratory disorders, in those women between the ages of 20 and 29, who had more respiratory and psychoneurotic disorders, and probably in those women aged 40 and over, who also had more psychoneurotic disorders.

The differences which were recorded over this period were not unusual ones, as the rates of surgery attendances and domiciliary visits during the 10 weeks were not unusually high or low for either of the groups concerned, so it seems reasonable to conclude that those families who lived in flats were not as healthy as those who lived in houses. The amount of ill-health in flats appeared to be considerable, but the degree less so. Though there was one death during the period—that of an infant living in a flat who succumbed to a fulminating virus pneumonia—if the degree of illness is judged by the number who had to be admitted to hospital this was proportionately the same in both groups (Table II).

Respiratory Infections

The classical reasons for an increased rate of respiratory infection—namely, overcrowding and poor ventilation—were not present by the accepted standards. These flats were of a good size, with two or three bedrooms, and centrally heated throughout, allowing free use of all the floor space in comfort; nevertheless, the floor space in modern flats usually approximates more closely to the minimum standards laid down for dwellings, bedrooms tend to be smaller than they are in houses, and the whole design is more compact than in a house, bringing the occupants into closer contact.

Apart from floor space, the main difference between a house and a flat is the ease of access to the open air in the

former, and this may well have been a major reason for the increased rate of respiratory infections among flat-dwellers. A child returning home from school to a house will probably go out to play in the garden, but one coming back to a flat tends to remain there. Though play areas were provided in the communal surrounds of the flats, and were used to some extent, one never saw as many children using the swings and slides even on a fine day, as might have been expected from the number of children in the neighbourhood. On the other hand, large numbers of children in the back gardens or playing on the communal lawn in front of houses were a far more usual sight. Mothers who live up several flights of stairs tend to use them as little as possible, and are naturally reluctant to let small children too far out of their sight, and the children themselves are often unwilling to stray too far from their mothers. A further indication that people tend to be less active and more confined when they live in a flat is the significantly higher rate of musculoskeletal disorders found during the period under review in the group living in houses.

If confinement to the flat is a factor in precipitating respiratory infections one would expect to find a higher incidence in those living above ground level than in those who were on the ground floor and therefore probably more likely to go out, and this was found to be the case, as is shown in Table VII.

TABLE VII.—*Incidence of First Attendance by the General Practitioners on Families Living in Flats for Respiratory Disorders, by Height of Residence*

Level of Flat	First Attendances for Respiratory Disorders	Population at that Level	Rate per 1,000 at that Level
Ground floor	68	351	193.7
First	71	49	203.4
Second	74	37	219.6
Third	31	126	246.0
Total	244	1,163	209.8

It will be seen that there was a small but steady increase in the incidence of respiratory disorders as the height of the flat increased, though the flats were of the same design and size on each floor. The smaller population living on the third floor is due to the fact that most of the blocks were only three storeys high.

Neuroses

Though few in number by comparison with respiratory ailments, the incidence of psychoneurotic disorders as judged by their first presentation to the general practitioners was nearly three times as high in women in their twenties who lived in flats as it was in those living in houses. The numbers recorded in both groups were probably lower than the true incidence, as an attendance was put into this category only when a firm diagnosis of psychoneurotic illness could be made. Many others which would probably fall into this category were recorded under the heading of "vague symptoms and no diagnosis," as this miscellaneous group included the occasions when a wife might come herself or even bring a child with some superficially trivial problem, just so that she could talk with a neutral person such as the doctor.

The degree of illness was not usually serious, and most of the cases could be and were treated by the general practitioners concerned, backed up by the health visitor. During the 10-week period five patients who lived in flats were referred to the psychiatrist, and three who lived in houses. There was one psychiatric admission to hospital, and this was of a woman who lived in a house. Nevertheless, these illnesses, however mild, are often prolonged and disabling, and tend to become recurrent. It was felt that those patients who presented with psychiatric symptoms were only the tip of the iceberg, and a high proportion of undisclosed and undiagnosed mental illness.

probably went unnoticed, and that part of the overall increase in the incidence of disorders in other categories, particularly gynaecological disorders, reflected underlying tensions and anxieties.

The causes were probably many, but there is no doubt that monotony and boredom played a considerable part. The flats were well appointed and designed to save labour, and women occasionally complained to their doctors about this, saying that the housework took so little time that there was nothing left to do. Again, because shopping facilities were close at hand, even a daily expedition took little time. It was possible to take a bus to another and bigger shopping centre, but, as with going for walks locally, this activity soon palled, and all that was left was confinement within the flat and introspection. If there were children below school age in the family this confinement became even more necessary, as they had to be watched all day. There was no small garden into which they could be released in safety, and they themselves eventually provided another irritant in their mothers' lives.

The most striking contrast between life in flats and that in houses was the lack of communication between families living in flats compared with those in houses, and this was probably the principal cause of the isolation and loneliness of the wives in the flats. Apart from the discussions in the surgery when this was revealed, it was noticed by the doctors and by the health visitor in the daily round, when one could observe the contrast during domiciliary visits. It was not uncommon to find neighbours visiting and talking when one visited a house, and if a wife was ill in bed the door would often be opened by a neighbour who had come in to help. This was not nearly so frequent in the flats, where it was more usual to find a wife coping by herself, or whose husband had had to stay away from work to help.

This phenomenon of isolation has previously been described as occurring on new housing estates, as in Young and Willmott's (1962) families who moved from Bethnal Green, and arises from the destruction of the matrilocal family structure, where mothers and their married daughters living near each other communicate frequently and form an extended family which is interdependent and which constitutes a self-sufficient social unit. Why, though, should this affect people who live in flats more than those who live in houses? Perhaps because in houses the children, instead of helping to confine their mothers indoors as they do in a flat, form a link between the women by bringing their mothers together when they play in their gregarious bands around the front doors. Stepping outside the front door or talking over the back-garden fence requires much less effort than climbing the stairs of a block of flats, and the gardens are neutral territory which do not involve the positive social act of going to call on someone in a flat. Thus the initial shyness of a woman who may be susceptible to mental illness may be broken and the illness prevented.

Some support for this can be found if the incidence of psychoneurosis is examined in relation to the height of the flat, and in Table VIII the women who made first attendances on the general practitioners at which a diagnosis of psychoneurotic disorder was made are divided according to the height

of the flat in which they lived. This shows that the incidence of psychoneuroses in women was twice as high if they lived on the top floor as it was in those who lived on the ground floor, and that there was a steady increase in incidence as the height of the residence increased.

Further support for this explanation of the situation is found in the observation that women in their thirties did not seem to suffer from mental illness if they lived in a flat any more than if they lived in a house. These were the women whose children were at school and therefore did not confine them to the flat. They were also those who went out to work, as many did in full- or part-time jobs in shops and offices, thus making social contacts and avoiding isolation.

The women aged 40 and over seemed to suffer because they were less tolerant of a new situation than the younger wives. They had been used to living in houses previously, and many could not adapt themselves to flat life.

With women of all ages it may have been that this increase in morbidity and intolerance of flat life would not have occurred but for the fact that their basic cultural pattern had already been disturbed, and that living in flats in a community which had a more acceptable social pattern would have been better tolerated.

Discussion

The health of this community might be expected to be relatively good, as they had committed themselves to a turbulent domestic life where they were expected to travel around the United Kingdom and overseas as the men's occupation required, and there was the possibility of an element of selection in this respect. They were, however, subject to stresses and lived under conditions which were very similar to those found in a new housing estate in England. The break in their family links was voluntary in that all the men had chosen the armed Services as their career, accepting the disturbance of family ties that must follow. This makes direct comparison with the health of a population on a new housing estate or in a new town in England difficult, but the increase in morbidity of the families who lived in flats does indicate that a health problem can exist and the nature of the illnesses which such a situation may precipitate.

With the two most important types of illness which arose in these families—namely, respiratory infections and psychoneuroses—though they may not be regarded as very serious at the time, they may both lead eventually to chronic disability. Recurrent respiratory infections in children will cause underlying structural damage and eventually chronic bronchitis and bronchiectasis, a pathological pattern already notorious in England. Even mild neurotic illnesses tend to be prolonged and difficult to treat successfully, and are apt to recur. The pattern of social withdrawal and confinement to the dwelling of young mothers and children is one which invites chronic ill-health, and is against all the tenets of good hygiene.

The problems of living in flats are recognized by some of the planners of new housing, but it is important that they, and more particularly doctors who work in general practice and in the field of public health, should attempt to evaluate them on a wider scale than has yet been done, and that public and private authorities who are responsible for building homes should be made aware of them. In particular, more research is needed into the problems of morbidity of families who have had a double social disturbance by being removed from their places of origin and also placed in a flat.

Summary

Two groups of families of members of the armed Services stationed in Germany were compared, one group living in

TABLE VIII.—Incidence of First Attendance by the General Practitioners on Females Aged 15 and Over for Psychoneurotic Disorders, by Height of Flat

Level of Flat	Females Aged 15 and Over		
	First Attendances for Psychoneurotic Disorders	Population	Rate per 1,000
Ground floor	8	127	63.0
First "	8	120	66.7
Second "	14	128	109.4
Third "	7	55	127.3
Total	37	430	86.0

flats and the other in houses. It was found that the morbidity of those families who lived in flats was 57% greater than of those who lived in houses, and that the greatest differences were seen in the incidence of respiratory infections in young women and children, and of psychoneurotic disorders in women.

The reasons for the differences in respiratory infections were felt to be the relatively small space available in a flat compared with that in a house, and confinement of the family within the flat. This confinement, and the resulting social isolation, were thought to be the reasons for the increase in psychoneuroses in the women.

The families concerned had had a double social disturbance in that their family ties had been severed and they were also subject to the restricting environment of life in a flat, and it is suggested that in view of the large number of flats which are being built, and the tendency towards family mobility,

further investigation is needed into the effects of flat life on health.

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REFERENCES

- Brotherston, J. H. F., and Chave, S. P. W. (1956). *Brit. J. prev. soc. Med.*, 10, 200.
 Hird, J. F. B. (1966). *J. Coll. gen. Practit.*, 12, Suppl. No. 1, p. 33.
 Martin, F. M., Brotherston, J. H. F., and Chave, S. P. W. (1957). *Brit. J. prev. soc. Med.*, 11, 196.
 Registrar General (1954). *Medical and Population Subjects Study*, No. 8. "Measurement of Morbidity." Report of the Statistics Subcommittee of the Registrar General's Advisory Committee on Medical Nomenclature and Statistics. H.M.S.O., London.
 Taylor, S. J. L., and Chave, S. P. W. (1964). *Mental Health and Environment*. London.
 Young, M., and Willmott, P. (1962). *Family and Kinship in East London*, 2nd ed. London.

Effect of Gastrin II on Gastric Emptying and Secretion During a Test Meal

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Hypersecretion of gastrin by an islet cell tumour of the pancreas is believed to be the cause of the Zollinger-Ellison syndrome (Zollinger and Ellison, 1955; Gregory, Tracy, French, and Sircus, 1960). Patients with this condition have extreme gastric hypersecretion and peptic ulceration. In one case described by Lawrie, Williamson, and Hunt (1962) there was also very rapid gastric emptying. This feature seemed to be explained when Smith and Hogg (1966) found that injected gastrin stimulated gastric motility as judged by measurements of intraluminal pressure. We therefore expected that an increase in the rate of gastric emptying would result from intravenous infusion of gastrin, but this was not so.

Procedure

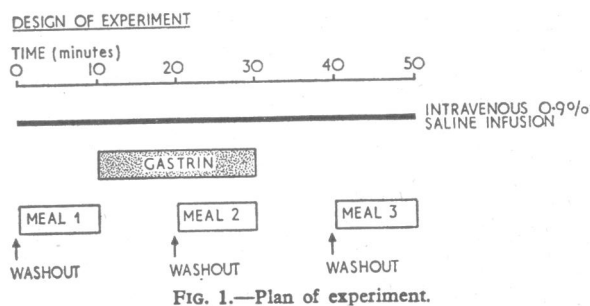
The plan of the experiments is set out in Fig. 1. Three test meals were given in succession with a 10-minute interval between them. For the 10 minutes before and during the second meal a continuous intravenous infusion of gastrin was given. The stomach was washed out with 250 ml. of water before each meal in order to remove any residual secretion. Each of the three tests of gastric emptying, which lasted 10 minutes, was separated from the subsequent test by 10 minutes. The meals consisted of 750 ml. of 100 mN sodium citrate containing 30 ml. of a saturated solution of phenol red per litre as marker. They were instilled down a tube into the stomach in about 75 seconds. This meal was chosen because it empties very rapidly; also it is buffered by the presence of the citrate ion, so minimizing the possible slowing action of secreted acid. Immediately after recovery of the first meal injection of gastrin into the running intravenous infusion was begun and continued for 20 minutes. Hog gastrin II was used in doses ranging from 0.125 to 3 μ g./min.

The recovered gastric contents were analysed according to the method of Hunt (1954, 1959). The volumes of original meal present in the recoveries were calculated as the product of the volume recovered and the ratio of its phenol red con-

centration to that of the original meal. The parietal secretion was calculated and expressed as millilitres of 160 mN HCl. The two of us, 75-kg. men aged 50 and 27, were the subjects for this investigation.

Results

The meal which was given during the infusion of gastrin left the stomach more slowly than the preceding or the succeeding meal. The minimal effective dose of gastrin in subject N.R.



was 0.5 μ g./min. (Fig. 2) and in subject J.H. 2 μ g./min. (Fig. 3). In both subjects the threshold for stimulating secretion of acid in the second meal was less than that required to slow emptying—0.125 μ g. in N.R. and 0.5 μ g. in J.H. (Figs. 4 and 5). With most doses the slowing of emptying had worn off in the 10 minutes between stopping the infusion of gastrin and giving the third meal. On the other hand, with the larger doses, 0.75 μ g. in N.R. and 2 μ g. in J.H., the secretion of acid in response to the third meal was greater than that in response to the second, though there was no injection of gastrin during the third meal.

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